Highlights from Recent Literature

1 Analytical

1.1 Spectra of Resonance Light Scattering of Gold Nanoshells: Effects of Polydispersity and Limited Electron Free Path

The effects of the polydispersity of the structure of Au nanoshells and of the limited electron free path in a thin metal layer on the spectra of resonance light scattering of a suspension of two-layer nanoparticles were studied theoritical and experimental for the 1st time. B Khlebtsov, V Bogatyrev, L Dykman, N Khlebtsov from the Institute of Biochemistry and Physiology of Plants and Microorganisms, Russian Academy of Sciences, Saratov, Russia, *Optics and Spectroscopy*, 2007, **102(2)**, 233. It is shown theoretically that both factors lead to a broadening of the plasmon resonance in light scattering and to a change in its magnitude. To experimentally test the calcinations, two samples of nanoshells based on Au and SiO2 (silica) were synthesized. Nanoshells of sample 1 have a diameter of the core of 90 nm and a broad thickness distribution of shells (with an av. value of 30 nm), whereas nanoshells of sample 2 have a diameter of the core of 70 nm and a narrow thickness distribution of shells (with an av. value of 12 nm). The core diameter, the shell thickness, and the polydispersity of the structure of nanoparticles are established by dynamic light scattering. The simulation of the optical properties of nanoparticles with their parameters estd. from the dynamic light scattering data makes it possible to obtain good agreement between experimental and theoretical spectra of light scattering. For nanoshells of sample 1, the inhomogeneous broadening of the scattering spectrum is completely determined by the polydispersity; therefore, the bulk consts. of Au can be used in simulation of the spectra of such nanoshells. The main mechanism of the broadening for nanoshells of sample 2 is connected with the limitation of the free path length of electrons, whereas the contribution from the thickness distribution of shells can be neglected.

2 Catalysis

2.1 Nanocrystalline Gold and Gold-Palladium as Effective Catalysts for Selective Oxidation

A review on oxidation catalysis. J Edwards, P Landon, A Carley, A Herzing, M Watanabe, C J Kiely, G Hutchings from the Department of Chemistry, Cardiff University, Cardiff, UK, *Journal of Materials Research* , 2007, **22(4)**, 831. Until recently, gold has been overlooked as a key component of both homogeneous and heterogeneous catalysts. However, the observation in the 1980s that nanocryst. gold supported on oxides was an effective catalyst for low-temperature carbon monoxide oxidation has now captured the imagination of many researchers. At present, low-temperature carbon monoxide oxidation remains an intensely studied field, but in recent years increased emphasis has been placed on using gold catalysts for selective oxidation For example, the oxidation of alkanes, alkenes, and alcohols. was effective with gold-based catalysts. In addition, gold-palladium bimetallic catalysts were effective in direct formation of hydrogen peroxide, and this will be described in this article.

2.2 Advances In Nano-Particulate Gold Catalysts

A review. Catalytic mechanisms and new characteristics of gold nanoparticle catalyst are reviewed using examples of low-temperature CO oxidation, gas-phase propylene oxide synthesis, liq.-phase reactions, and gold cluster. I Okuda, J Kawahara, M Haruta from the Department of Appl. Chem., Grad. Sch. Urban Environ. Sci., Tokyo Metropolitan University, Hachioj, Japan *Materia,* 2007, **46(4)**, 265

2.3 Enhanced Activity for Electrocatalytic Oxidation of Carbon Monoxide on Titania-Supported Gold Nanoparticles

Investigation of particle-size- and substrate-dependent activity for the electrochem. oxidation of CO provides an opportunity to consider the origin of the unique activity of supported Au nanoparticles in a new light. B Hayden, D Pletcher, J Suchsland from the School of Chemistry, University of Southampton, Southampton, UK, *Angewandte Chemie, International Edition*, 2007, **46(19)**, 3530. Also, manipulation of catalytic activity by particle size and support provides an important tool for the future optimization of electrocatalysts.

2.4 Co-Existence of Various Active Gold Species in Au-Mordenite Catalyst for CO Oxidation

Different structural and electronic states of gold species in H-mordenite with SiO_2/Al_2O_3 molar ratio 206 and their transformations under redox treatments have been studied by the methods of diffuse reflectance UV-visible spectroscopy and FTIR spectroscopy of adsorbed CO. I Tuzovskaya, A Simakov, A Pestryakov, N Bogdanchikova, V Gurin, M Farias, H Tiznado, M Avalos from CCMC-UNAM, Ensenada, BC, Mexico, *Catalysis Communications*, 2007, **8(7)**, 977. Different states of ionic and metallic gold were detected in the zeolite channels and on the external surface of the zeolite - Au^+ and Au^{3+} ions, charged clusters Au.delta.+n, and neutral nanoparticles Aum. Catalytic tests of the samples revealed the co-existence of several types of active species of gold in CO oxidation - gold clusters <1.5 nm (responsible for low-temperature activity) and gold nanoparticles (responsible for high-temperature activity).

2.5 Gold Supported on Cu-Mg-Al-Mixed Oxides: Strong Enhancement of Activity in Aerobic Alcohol Oxidation by Concerted Effect of Copper and Magnesium

Gold nanoparticles were deposited on mixed oxides containing Cu, Mg, and Al in different ratios. The mixed-oxide supports were prepared by flame spray pyrolysis (FSP), resulting in agglomerated primary nanoparticles in the 10-15 nm range, onto which 6- to 9-nm gold particles were deposited by means of deposition-precipitation. P Haider, A Baiker from the Department of Chemistry and Applied Biosciences, Institute for Chemical and Bioengineering, ETH Zuerich, Zurich, Switz.

Journal of Catalysis, 2007, **248(2)**, 175. The mixed-oxide-supported Au catalysts with noble metal loading of 0.6 .+-. 0.17 wt% were investigated concerning their structural properties and tested in the aerobic liq.-phase oxidation of 1-phenylethanol to phenyl-Me ketone affording TOFs up to 1300 h-1. The catalytic tests showed that the activity of these catalysts depends strongly on the compn. of the support, with Cu and Mg being crucial components. Strongly enhanced catalytic activity was observed for gold supported on a ternary mixed oxide contg. Cu, Mg, and Al at the molar ratio of 5:1:2. Extension of the catalytic tests to various structurally different alcs. indicated that the ternary mixed-oxide-supported gold catalyst has excellent catalytic properties in the aerobic oxidation of a broad range of structurally different alcs., affording selectivities .gtoreq. 98%. XANES revealed both reduced and oxidized Au species on the ternary mixed-oxide supports before and after the reaction. CO_2 adsorption from the liq. phase combined with in situ ATR-IR and modulation excitation spectroscopy was applied to investigate differences in the basic surface properties of the mixed oxides. Monodentate and bidentate carbonates were identified, the former being dominant on ternary Cu-contg. supports.

2.6 Synergistic Activity of Gold-Platinum Alloy Nanoparticle Catalysts

The understanding of the composition-activity relation is essential for the exploitation of the synergistic properties of multimetallic nanoparticles in catalytic reactions. D Mott, J Luo, P Njoki, Y Lin, L Wang, C J Zhong from the Department of Chemistry, State University of New York at Binghamton, Binghamton, NY, USA, *Catalysis Today*, 2007, **122(3-4)**, 378. This paper focuses on the discussion of findings from the study of bimetallic Au-Pt (AuPt) nanoparticles of different compositions IR spectroscopic data for CO adsorption on SiO_2-supported AuPt nanoparticles reveal that the surface binding sites are dependent on the bimetallic composition The analysis of this dependence further indicated that the relative Au-atop and Pt-atop sites for the linear CO adsorption on the nanoparticle surface are not only correlated with the bimetallic composition, but also with the electronic effect of the d-band shift of Pt in the bimetallic nanocrystals, which is the 1st demonstration of the nanoscale core-surface property correlation for the bimetallic nanoparticles over a wide range of bimetallic composition. A further examination of the electrocatalysis data for MeOH oxidation reaction on C-supported AuPt nanoparticle catalysts reveal important insights into the participation of CO or OH adsorption on Au sites and the catalytic activity of Pt in the AuPt alloys with relatively high Au concentration. Implications of these findings to synergistic correlation of the bifunctional activity of the bimetallic nanoparticle catalysts with the bimetallic composition are also discussed.

2.7 In Situ Measurements Under Flow Condition of the CO Oxidation Over Supported Gold Nanoparticles

In situ FT-IR measurements for Au/TiO_2 and Au/Al_2O_3 have been carried out under the flow condition of CO oxidation at atmospheric pressure. It has been found that the Au particles remain neutral (Au0) in the presence of oxygen, while negative charged particles (Au.delta.-) is formed in the absence of oxygen, as a result of the charge transfer from the oxygen vacancies. Moisture did not significantly affect the adsorption states of CO over Au/TiO_2 and Au/Al_2O_3. Enhancement of the CO2 production by moisture was observed over Au/Al_2O_3, which is accompanied by the decomposition of carbonate-like species by moisture.

2.8 High Activity Supported Gold Catalysts by Incipient Wetness Impregnation

It is generally thought that catalysts produced by incipient wetness impregnation (IW) are very poor for low temperature CO oxidation, and that it is necessary to use methods such as deposition-precipitation. (DP) to make high activity materials. M Bowker, A Nuhu, J Soares, from theSchool of Chemistry, Cardiff University, Cardiff, UK,*Catalysis Today*, 2007, **122(3-4)**, 245. The former is true, indeed such IW catalysts are poor, and we present reactor data, XPS and TEM anal. which show that this is due to the very negative effect of the chloride anion involved in the precipitation, which results in poisoning and excessive sintering of the Au particles. With the DP method, the chloride is largely removed during the precipitation and so poisoning and sintering are avoided. However, we show here that, contrary to previous considerations, high activity catalysts can indeed be prepared by the incipient wetness method, if care is taken to remove the chloride ion during the process. This is achieved by using the double impregnation method (DIM). In this a double impregnation of chloroauric acid and a base are made to ppt. out gold hydroxide within the pores of the catalyst, followed by limited washing. This results in a much more active catalyst, which is active for CO oxidation at ambient temperature The results for DIM and DP are compared, and it is proposed that the DIM method may represent an environmentally and economically more favorable route to high activity gold catalyst prodn.

2.9 Structural and Chemical Promoter Effects of Alkali (Earth) and Cerium Oxides in CO Oxidation on Supported Gold

Nanostructured Au/Al_2O_3 catalysts prepared by deposition-precipitation with urea were characterized by X-ray

diffraction (XRD) and high-resolution transmission electron microscopy (HRTEM) and tested for low temperature CO oxidation A Gluhoi, B Nieuwenhuys from the Department of Heterogeneous Catalysis and Surface Chemistry, Leiden Institute of Chemistry, Leiden University, Leiden,
Catalysis Today, 2007, **122(3-4)**, 226. The paper is focused on the effect of two different kinds of additives on the structure and reactivity of Au/Al_2O_3 for CO oxidation: (1) alkali (earth) metal oxides and (2) ceria. The structural properties of nanosized Au particles are drastically affected by the presence of additives. The main role of the alkali (earth) metal oxides is to stabilize the small Au particles against sintering, such that when BaO is added to Au/Al_2O_3, full CO conversion is already achieved at room temperature For this reaction ceria addn. does not result in a higher activity. However, when both BaO and CeOx are added to Au/Al_2O_3, the catalytic performance of the multicomponent catalyst resembles that of $Au/BaO/Al_2O_3$.

2.10 Influence of the surface area of the support on the activity of gold catalysts for CO oxidation

In the precipitation of 1% Au/TiO_2 catalysts supported on either Degussa P-25 or anatase (90 m2 g-1) by deposition-precipitation, the gold content passes through a max. at about the isoelec. point (pH .apprx.6), but max. specific rates occur at pH 8-9 because the Au particle size becomes smaller as the pH is further increased. F Moreau, G C Bond from the Institute for Materials Research, University of Salford, Salford Greater Manchester,UK,*Catalysis Today*, 2007, **122(3-4)**, 215.The gold uptake increases with the surface area of the support (anatase, rutile, P-25) and is complete above 200 m2 g-1; adsorption of the gold precursor at pH 9 is shown to be equil.-limited. Highest activities are found with supports of .apprx.50 m2 g-1. Catalysts made with high-area anatase (240 or 305 m2 g-1) are least active but show least deactivation. With Au/SnO_2 catalysts, gold uptake does not depend on the area of the support, and is highest at pH 7-8; very active catalysts (T50 = 230-238 K) are obtained using SnO2 of 47 m2 g-1. Storing a catalyst at 258 K for 1 wk dramatically improves its stability. Results for Au/CeO_2 and Au/ZrO_2 catalysts confirm that moderate support areas give the most active catalysts, and suggest that surface area is often more important than chemical composition.

3 Chemistry

3.1 Fast Colorimetric Detection of Copper Ions Using L-Cysteine Functionalized Gold Nanoparticles

This communication reports an efficient visual detection method of Cu^{2+} by L-cysteine functionalized gold nanoparticles in aq. solution. W Yang, J Gooding, L He,L Zhicong G Chen from the School of Chemistry, The University of New South Wales, Sydney, Australia, *Journal of Nanoscience and Nanotechnology*, 2007, **7(2)**, 712. Upon exposure to Cu^{2+}, the gold nanoparticle solution changed from red to blue, in response to surface plasmon absorption of dispersed and aggregated nanoparticles. This colorimetric sensor allows a rapid quant. assay of Cu^{2+} down to the concentration range of 10-5 M. Recognition of Cu^{2+} and formation of the aggregates probably occur via a 2:1 sandwich complex between L-cysteine and Cu^{2+}.

4 Electrochemistry

4.1 Effects of Temperature Reduction On Monolayer-Protected Gold Nanoparticle Capacitance

The electrochem. of monolayer-protected Au nanoparticle (MPC) solns. at reduced temps. was studied using differential pulse voltammetry. Odonkor, Charles A.; Owens, Stephanie A.; Turbeville, Heather L.; Gray, Cynthia G.; Miles, Deon T. The University of the South, Sewanee, TN,USA, *Journal of Electroanalytical Chemistry*, 2007, **603(1)**, 35. Different tetrabutylammonium electrolytes in CH2Cl2 were compared in the anal. of the hexanethiolate-protected Au nanoparticles (C6-MPCs). In agreement with Gouy-Chapman-Stern (GCS) theory, the double-layer capacitance (C MPC) of the C6-MPCs increased with decreasing soln. temperature Sep. electron transfers in redox-modified MPCs were observed Electron transfer to and from the MPC Au core was observed simultaneously with the electron transfer of the attached anthraquinone mols. The resulting double-layer capacitance of the anthraquinone-modified nanoparticles (AQ-MPCs) was detd. at various temps. There was less correlation between temperature and capacitance in the AQ-MPCs. AQ-MPCs were synthesized with the anthraquinone mol. at 2 different chain lengths from the Au core surface. The shorter-chain AQ-MPC exhibited better resolved electron transfer peaks from the Au core, while the voltammetry of the longer-chain AQ-MPC had better resolved anthraquinone peaks. Additional, this was the 1st observation of quantized double-layer (QDL) charging events from a nonethanol-sol. (NES) fraction of MPCs that were functionalized.

5 Electronics and Sensors

5.1 The Effects of Multiple Zincation Process on Aluminum Bond Pad Surface for Electroless Nickel Immersion Gold Deposition

This paper reports the effects of a multiple zincation process on the Al bond pad surface prior to electroless nickel immersion gold deposition. M Md Arshad, I Ahmad, A Jalar, G Omar, UHashim from the School of Microelectronic Engineering, Kolej Universiti Kejuruteraan Utara Malaysia, Perlis, Malay, *Journal of Electronic Packaging*, 2006, **128(3)**, 246. The study of multiple zincation comprises the surface topog. and morphol. of the appearance of the Al bond pad. In addition, by comprehension of the effects of the multiple zincation process, the study includes investigating the Al dissoln. rate and adhesion strength between eutectic a 37 Pb/63 Sn solder ball and an under bump

metallurgy (UBM) interface. SEM, energy dispersive x-ray, at. force microscopy, focused ion beam, and an Intellectest STORM series FA1500 shear tester were used as anal. tools in this study. The results suggest that the first zincation process follows the contour of the initial bond pad. The second zincation produces a slightly better surface appearance with a smooth and fine Zn crystallite. The Zn crystallites become a continuous film with the deposits looking like an island formation after the third zincation. The smooth surface of the third zincation, as an effect of multiple zincation, is later transferred to Ni and Au surfaces. The smooth surface of the UBM leads to a better shear strength with only a min. Al dissolved.

5.2 Optical Properties of Platinum-Coated Gold Nanorods

The optical properties of Au/Pt nanorods with different morphologies are analyzed in detail through comparison of experimental UV-visible-NIR spectra and calcns. based on the boundary element method (BEM). MGrzelczak, J Perez-Juste F Garcia de Abajo, L Liz-Marzan from the Departamento de Quimica Fisica and Unidad Asociada CSIC, Universidade de Vigo, Vigo, Spain, *Journal of Physical Chemistry C*, 2007, **111(17)**, 6183. The studied morphologies refer to 2 different Pt deposition modes on Au nanorods, which were experimentally realized through the presence or absence of Ag+ ions in soln. While in the absence of Ag+, complete overcoating was obtained, the presence of these ions induced preferential growth on the tips, as recently reported by one.1 The changes in the optical spectra are different for both Pt deposition modes, and this is fully accounted for using appropriate geometrical models in the BEM calculations. The presence of Pt tips is shown to lead to red shifts of the longitudinal plasmon band because of geometrical effects, though accompanied by damping due to increased absorption.

6 Medical and Dental

6.1 Gold Nano-Particles Instead of Gold Ingot

A review on application of Au nanoparticles to biol. and medical fields. C Kojima; K Kono from the Grad. Sch. of Engineering, Osaka Prefectural Univ., Japan, *Kagaku (Kyoto, Japan)* 2006, **61(12)**, 64

6.2 Cell Selective Response to Gold Nanoparticles

Gold nanoparticles (GNPs) are considered a potential probe to detect cancer. The present article investigates whether GNPs, even in the absence of any specific functionalization, induce any cell-specific response. H Patra, S Banerjee, U Chaudhuri, P Lahiri, A Dasgupta from the Department of Biochemistry, Calcutta University, Kolkata, India ,*Nanomedicine* (New York, NY, United States) 2007, **3(2)**, 111. The authors report GNP-induced death response in human carcinoma lung cell line A549. In contrast, the 2 other cell lines tested, BHK21 (baby hamster kidney) and HepG2 (human hepatocellular liver carcinoma), remained unaffected by GNP treatment. The specificity of the induction of the death response in A549 cells implies that GNPs do not universally target all cell types. Flow-cytometric studies indicated that the response was dose dependent and had a threshold effect (in A549). Gradual increase in GNP concentration induces a proportional cleavage of poly(ADP-ribose) polymerase. The programmed nature of the death response is implied, because such cleavage follows activation of caspases. Notably, at higher GNP concentration there was an asym. accumulation of GNPs in the periphery outside the cell nucleus of the A549 cells. This was confirmed by confocal microscopy, a green scattering (possibly, surface-enhanced Raman effect) appearing on selective z-slices of the image.

7 Metallurgy, Materials and Coatings

7.1 An Evaluation of Gold and Copper Wire Bonds on Shear and Pull Testing

In microelectronic packaging technol. wire bonding is a common interconnect technique. The quality and reliability of wire bonds are generally evaluated by ball shear and stitch pull testing. S Murali,N Srikanth, C Vath from ASM Technology Singapore, Singapore, *Journal of Electronic Packaging*, 2006, **128(3)**, 192. From the load vs. time and load vs. tool tip displacement plots of the shear test, three regions can be observed Region I primarily exhibits elastic-plastic deformation occur, while crack nucleate in region II which propagates in region III which finally ends in a catastrophic failure. Fractographs reveal in the case of gold ball bonds shows fracture occurs in Al bond pad metalization close to Au-Al intermetallics. In Cu ball bonds of 1, 2, and 4 mL wire sizes also Al bond pad metalization cracks but penetrate deeper into the pad which indirectly shows that the bonding layer is stronger than that of gold ball bonds. Optical microscopic observation of the sheared copper bond surfaces reveal sticking of Al which provides qual. information of the area of the bond between the ball bond and the bond pad. In thermally aged gold ball bonds, the gold above the intermetallic layer fractures. The energy required to fracture a gold or copper ball bond of 1 mL wire size is around 370 J/m2, while an aged gold ball bond consumes about 520 J/m2. Void nucleation and coalescence mechanism of ductile fracture takes place in the ball and stitch bonds, however, silicon particles may be the preferential void nucleation sites in bond pad aluminum metalization failures. To understand the second bond strength, a stitch pull test was conducted and the results showed the neck of the stitched wire cracks thus leaving behind a tail bond on the lead finger.

8 Nanotechnolog

8.1 Gold Nanoparticles Protected with Ph and Temperature-Sensitive Diblock Copolymers

Aqueous dispersions of gold nanoparticles protected with a stimuli-sensitive diblock copolymer were studied

as a function of pH and temperature Methacrylic acid-N-isopropylacrylamide diblock copolymer was synthesized by using the reversible addn. fragmentation chain transfer polymn. technique. M Nuopponen, H Tenhu, from the Laboratory of Polymer Chemistry, University of Helsinki, Helsinki, Finland, *Langmuir*, 2007, **23(10)**, 5352. A one-pot method utilizing the dithiobenzoate functionalized polymer was used to prep. gold nanoparticles protected with the diblock copolymer. The gold nanoparticles coated with the block copolymer, with the N-isopropylacrylamide block bound to the particle surface and methacrylic acid as an outer block forming stimuli-sensitive aggregates in water. The changes in the absorption maxima of the surface plasmon resonance of the gold particles and in the size of the aggregates were investigated as a function of pH and temperature PH affected the size of the aggregates, whereas the effect of temperature was moderate. However, a blue shift in the surface plasmon resonance was observed both with decreasing pH and increasing temperature Whereas the methacrylic acid blocks control the colloidal stability of the particles and their aggregates, the thermo-sensitive isopropylacrylamide blocks have a noticeable effect on the polarity of the immediate surroundings of the particles.

8.2 Determination of Size and Concentration of Gold Nanoparticles from UV-Vis Spectra

The dependence of the optical properties of spherical gold nanoparticles on particle size and wavelength were analyzed theoritical using multipole scattering theory, where the complex refractive index of gold was cor. for the effect of a reduced mean free path of the conduction electrons in small particles. W Haiss, N Thanh, J Aveyard, D Fernig from the Centre for Nanoscale Science, Department of Chemistry, University of Liverpool, Liverpool,UK, *Analytical Chemistry (Washington, DC, United States)*, 2007, **79(11)**, 4215. To compare these theoritical results to experimental data, gold nanoparticles in the size range of 5 to 100 nm were synthesized and characterized with TEM and UV-visible. Excellent agreement was found between theory and experiment The data produced here can be used to detect both size and concentration of gold nanoparticles directly from UV-visible spectra. Equations for this purpose are derived, and the precision of various methods is discussed. The major aim of this work is to provide a simple and fast method to detect size and concentration of nanoparticles.

8.3 Preparation of Gold/Iron Oxide Composite Nanoparticles by a Laser-Soldering Method

Gold and magnetite composite nanoparticles have been prepared by a unique laser process. K Kawaguchi, J Jaworski, Y Ishikawa, T Sasaki, N Koshizaki from the Nanoarchitectonics Research Center, National Institute of Advanced Industrial Science and Technology (AIST), Ibaraki, Japan
IEEE Transactions on Magnetics, 2006, **42(10)**, 3620. Both source colloid solns. of gold and magnetite were mixed and irradiated by an Nd:YAG laser (532 nm). The composite formation by a "nanosoldering" effect was confirmed by microscope observations.

8.4 Preparation of Gold Sol by Chemical Reduction

Chem. methods for preparing superfine gold sol was studied. In an acidic aq. medium, the concentrated chloroauric acid solution was reduced by ascorbic acid as reductant into global superfine gold powder with the maximal size less than 20 nm. C Zhang, X Lan from the School of Metallurgical Engineering, Xi'an University of Architecture and Technology, Xi'an, Peop. Rep. China , *Xiyou Jinshu 2006*, **30(4)**, 549. The factors affecting the particle size of gold were studied. These factors were temperature, the concns. of reductant, dispersant content, and pH. The optimal conditions were: pH = 3-5; PVP/HAuCl4 = 1; C6H8O6/Au = 3; normal temperature This method had the advantages of no need of stirring, no resolving of gold, and low cost.

9 Refining

9.1 Pretreatment with Ozone for Gold and Silver Recovery from Refractory Ores

Ozonization was studied as pretreatment for 2 Mexican refractory ores in order to increase the Au and Ag extn. Two methods for contacting ozone with the mineral were studied (indirect and direct). A Nava, R Elorza S Uribe G Perez, CNVESTAV Saltillo, Coahuila, Mexico, Ozone: *Science & Engineering*, 2007, **29(2)**, 101.The indirect method did not change the precious metals recoveries for mineral sample A, but increased those of mineral B (from 53 to 88% for Au and from 26 to 78% for Ag). The direct pretreatment, only tested in mineral A, did not affect Au and Ag recoveries but decreased the extn. time from 40 to 24 h for max. metal recovery.

9.2 Pulsed Power Breaking-Up Technology for Resistant Gold-Containing Ores and Beneficiation Products

The aim of this paper is basically to show progress in the study of nanosecond processes involved in the disintegration and breaking-up of mineral complexes with fine noble metals. V Chanturiya, I Bunin, from the Research Institute of Comprehensive Exploitation of Mineral Resources, Russian Academy of Sciences, Moscow, Russia, *Proceedings of the International Conference on Environmental Degradation of Materials in Nuclear Power Systems–Water Reactors, 12th, Salt Lake City, UT, United States, Aug. 14-18, 2005*, 2005, 93-102.The influence was studied of nanosecond High-Power Electromagnetic Pulses (HPEMP) on the phys. and technol. properties of refractory gold-contg. ores and beneficiation products. Experimental data are presented to confirm the formation of breakdown channels and selective disintegration of mineral complexes as a result of pulse irradn., which makes for efficient access of lixiviant solns. to precious metal grains and enhanced precious metal recovery into lixivia during

leaching. Preliminary processing of gravity concentration with a HPEMP resulted in significant increase of gold and silver extn. into lixivia during the cyanidation stage, with gold recovery increased by .apprx.31% (from 51.2% in a blank test to 82.3% after irradn.). Gold recovery from stale gold-contg. dressing tailings products increased after pulses-irradn. from 8-12% to 80-90%.

9.3 A Review on Bioleaching Mechanism And Electrochemistry of Arsenic-Bearing Gold Ores

A review. The bioleaching of arsenic-bearing refractory gold ores offers an effective pretreatment technol., which is an environmentally friendly process and able to improve the gold recovery. H Li, H Cao, G Zhang, Y Zhang, Z Fang from the Institute of Process Engineering, Chinese Academy of Sciences, Beijing, Peop. Rep. China, *Guocheng Gongcheng Xuebao*,2006, **6(5)**, 849.In the present article, the chem. reaction mechanism, leaching kinetics, biochem., electrochem., and process intensifying technologies occurring in the bioleaching process of sulfide minerals are reviewed.

9.4 Study on Treatment of Gold Flotation Concentrate with Thiourea/CIP Process

The thiourea/CIP process for gold extraction of a certain kind of gold flotation concentration was investigated. C Sun, G Tian, Y Xia, W Zhu, Wenhong from the Department of Chemical Engineering, Fushun Vocational Technical Institution, Fushun, Liaoning, Peop. *Rep. China, Guijinshu*, 2007, **28(1)**, 1. The factors affected the process were studied. The leaching rate and adsorption rate of gold reach 87.31% and 98.78%, resp. The technol. has many advantages, such as high leaching rate and adsorption rate, short leaching time and contacting time, and without environment pollution.